

# Water Resources

## Introduction

The availability of water is one of the most critical factors in planning for the future of our growing county. Adequate supplies of high-quality water are essential for human communities and healthy **ECOSYSTEMS**. Long-term drought cycles are expected to continue impacting supplies in our **SURFACE WATER** and **GROUNDWATER** systems, making our ability to meet the county’s ever-increasing demands more difficult. Managing our water resources is essential. However, the County’s authority is determined by overriding state law that limits its role in assessing the impacts of development on this critical resource. Obtaining greater local or regional control over water issues is one of the County’s biggest challenges.

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This Element describes traditional and alternative water sources available in Coconino County, addresses water quality issues, and outlines the benefits of **WATER CONSERVATION**. It also provides an overview of the regulatory framework for water resources and the constraints that the County faces in controlling water issues.

SEE ALSO	APPENDIX D
Water Resource Considerations	

## The Conservation Framework Relationship

This Water Resources Element is related to the **CONSERVATION FRAMEWORK** because water supplies are not only essential for human life, but also for healthy ecosystems and habitat. Its goals and policies address the role of conservation in this drought-adapted environment, where growth and development are occurring regardless of whether long-term water supplies are readily available.

The *Time* and *Ecological Processes* principles factor into the goals and policies of this Element most strongly. In addition, **CONSERVATION GUIDELINES A, G, H, I, J, & K** are particularly important because they address the long-term consequences we face if we do not manage this precious resource wisely.

## Our Purpose & Vision

The residents of Coconino County and the **NATURAL ENVIRONMENT** need clean water to survive. As growth continues, we envision using creative approaches to ensure the long-term availability of our water resources. This Element addresses concerns about water by establishing policies that encourage an efficient management and regulatory infrastructure—one that works with all entities involved in water management. These policies also encourage residents to conserve existing water resources, develop alternative sources of collecting and distributing water, and reuse water whenever possible.



## Water Sources

### SURFACE WATER

Water found in lakes, ponds, and reservoirs or flowing on the earth's surface within a stream, wash, creek, or other natural drainage channel.

### GROUNDWATER

The water stored under the surface in an aquifer that forms a natural reservoir. Groundwater typically discharges via wells or springs.

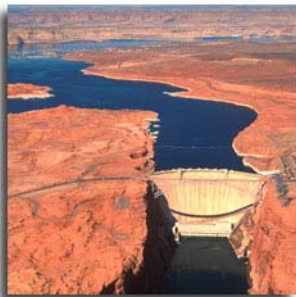
### RECHARGE

The addition to, or replenishing of, groundwater in an aquifer by natural or artificial means.

### SEE ALSO

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Water Conservation & Alternative Sources



Grand Canyon Trust

The **ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR)** defines four categories of water supplies: the Colorado River, **SURFACE WATER** (other than the Colorado River), **GROUNDWATER**, and **EFFLUENT**. Colorado River water is classified separately because of the complex legal issues associated with this resource, issues that involve many states and jurisdictions.

Surface water reservoirs have historically supplied a significant portion of the drinking water required for both Williams and Flagstaff. However, because drought conditions lowered reservoir levels dramatically in the late 1990s, these cities rely on deep groundwater sources, like most communities in Coconino County. The City of Flagstaff, for example, obtains much of its water supply from wells in the Lake Mary and Woody Mountain area. Most groundwater in the county is withdrawn from a system of **AQUIFERS** in several different **WATERSHEDS** and basins. These aquifers contain water that may be several thousands of years old. The most significant regional aquifers lie within deep bedrock layers—sandstones, limestones, and shales—at depths of 1,000 to 3,000 feet. These aquifers are slowly **RECHARGED** by rain and snow, which **PERCOLATE** downward from the surface and flows along fractures in the bedrock, sometimes over great distances. For example, some **SPRINGS** that **DISCHARGE** along the Colorado and Verde Rivers originate from groundwater flowing through aquifers in the Coconino Plateau watershed. Because flow patterns are regional in extent, pumping at one location may affect groundwater, springs, or surface water in a different geographical area or jurisdiction.

The impact of climate change on our water supplies is becoming more apparent as historically arid trends continue throughout Coconino County and most of the west.<sup>29</sup> The drought cycle that began in 1996 has reduced groundwater recharge and decreased surface water flows, impacting our **LANDSCAPES** significantly. As surface water flows decrease, we must rely more on groundwater sources. Not only does groundwater cost more to provide than surface water, but we face additional costs if we need more wells. The drought also impacts wildlife as well as ranchers who rely on surface water in stock ponds. Climate studies provide important information for water resource planning. Some have examined historical conditions over the past 3,000 years via tree rings; others, such as the USGS' *Precipitation History of the Colorado Plateau Region 1900–2000*,<sup>30</sup> address more recent conditions. Long-term records indicate that droughts spanning several decades are likely to occur in the future. Although flood cycles seem to be shorter, they must also be addressed through water resource planning. Not only must we ensure that impoundments are adequate, but we can also benefit from looking at ways to direct floodwaters to groundwater recharge areas.

Like most natural resources, groundwater and surface water do not respect jurisdictional boundaries. Many incorporated jurisdictions have developed their water supplies in aquifers that lie outside their boundaries—the same sources that surrounding unincorporated areas would tap if they were developing water systems. Given the regional nature of groundwater systems, it is critical for incorporated and unincorporated interests to work together.

**Goal:** **Ensure a water supply for human communities while considering the needs of natural systems.**

### Policies:

1. The County should take climatic variables into consideration in planning for water resource needs for the purpose of identifying long-term local and regional water resource strategies. *SEE CONSERVATION GUIDELINES: G, H, J, K*
2. The County encourages the protection of environmentally sensitive lands that rely on surface water and groundwater. *SEE CONSERVATION GUIDELINES: B, C*



## Water Providers

Unlike many incorporated cities and towns, Coconino County is not a water provider. However, although some incorporated communities in the county provide water, they typically do not extend service beyond their city or town limits. **HAULING WATER** is a common practice for residents of unincorporated areas, who can haul water themselves or purchase it from a commercial hauler; in some cases, they can also obtain it from water districts and owner cooperatives, shared wells, private water systems, or nonmunicipal public water systems.<sup>31</sup> State law defines a public water system as one that provides **POTABLE WATER** to at least 15 service connections or regularly serves at least 25 persons for at least 60 days a year. A private system is one that does not meet this standard. Private water companies replace municipal utilities in many unincorporated areas. A number of small water systems serve subdivisions and communities in the county, including Flagstaff Ranch Water Company, Forest Highlands Water Company, Arizona Water Company, and Starlight Water Company.

Hauling water is a common practice among residents in remote areas. The community of Tusayan has relied on hauled water to meet commercial needs for many years. Most municipalities provide water outside their incorporated boundaries via standpipes for bulk water sales by coin or card; this is also true for some nonmunicipal public water systems. In some areas—Bellemont and Valle, for example—wells have been developed primarily for bulk water sales but are not part of a distribution system. The number of residents who rely on hauled water was significant enough to warrant special attention in the *North Central Arizona Water Demand Study Phase I Report* prepared for the **RURAL ARIZONA WATERSHED INITIATIVE**. This report notes: “The study team knows of few other areas where this practice [is] so prevalent, and where growth appears to be fairly robust in spite of the lack of water system connections or easy access to groundwater.”<sup>32</sup> Unfortunately, many communities that sell water have adopted drought policies that would restrict sales to county residents.

Importing water from outside sources may be possible in some areas. For example, Canyon Forest Village proposed an elaborate plan to import water rather than rely on local wells. Another option that has been discussed is constructing a pipeline from Lake Powell to parts of the Navajo Reservation and extending it to other areas in the county.

As of 2003, the county only had two water districts—the Forest Lakes Domestic Water District and the Kachina Village Improvement District (KVID). Water districts are formed by area residents to raise money to take over an existing system or to develop a new system. In the early 2000s, interest in water districts was primarily from rural residents looking to develop a community well and standpipe, not a complete distribution system. These residents may have been cut off from sources such as municipalities that restrict outside water sales. Doney Park Water is the only owner cooperative in the county. All customers on the system are members, and an elected Board of Directors and staff run the operation. In some areas, particularly subdivisions, individual lot owners have developed a private system of shared wells. Clear Creek Pines is an example of a **SUBDIVISION** where owners have worked together to develop a well, storage, and line extensions for a limited number of homes. Typically, establishing such a system is easiest in areas where neither the cost to develop a well nor the distance for line extension is cost-prohibitive. **SPRINGS** provide water to many areas, most notably Oak Creek Canyon and the Arizona Strip. They are generally considered groundwater and fall under the same regulations as wells.

### SEE ALSO APPENDIX D

Water Resource Considerations  
– Rural Arizona Watershed  
Initiative



John Aber



John Aber



**Goal:** Ensure that a range of water types are provided for human use through an efficient and ecologically responsible manner.

**Policies:**

3. The County shall provide assistance to residents in the formation of water districts.  
*SEE CONSERVATION GUIDELINE: G*
4. The County supports efforts of water utilities to promote conservation measures and demand-side management practices<sup>33</sup>. *SEE CONSERVATION GUIDELINE: G*

## Water Conservation & Alternative Sources

### WATER HARVESTING

The collection of rain or snow-melt for retention and future use or recharge.

### RECLAIMED WATER

Wastewater that has been treated for reuse for purposes other than human consumption.

### GRAY WATER

Wastewater, collected separately from sewage flow, that originates from a clothes washer, bathtub, shower, or sink, but not from the kitchen sink, dishwasher, or toilet.

### WASTEWATER

Used water drained from homes, business, and industries; primarily sewage flow.

If annual growth continues at a rate of 2 to 3 percent in Coconino County, demands on our water supplies will continue to increase. Although developing new water sources will become critical, we must also consider other alternatives to meet these demands. One alternative is conserving water through the use of low-flow plumbing devices, drought-tolerant **LANDSCAPING**, and other approaches that reduce consumption. Another is identifying nonpotable water sources—for example, **GRAY WATER** and treated **WASTEWATER**—that could be “reused” for nonpotable needs such as landscaping, agriculture, golf courses, and parks, along with some commercial/industrial purposes. In 2001, the **ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ)** adopted regulations that allow residential users to reuse gray water, which originates in their household. Although the regulations contain specific rules, no formal review or permit is required. **WATER HARVESTING**, another option, is basically redirecting local surface and building **RUNOFF** and collecting it.

Many users in the county already rely on alternative water systems. Tusayan, for example, became a leader in reusing treated wastewater, or **RECLAIMED WATER**, because of the economics of providing potable water there. In 2002, this community met approximately 40 percent of its needs with reclaimed water. Hotels, restaurants, and at least one multifamily housing complex are “double-plumbed” to use reclaimed water for toilet flushing and landscaping. In 1988, KVID developed a 160-acre **WETLAND** to dispose of its treated wastewater. This wetland not only helps recharge the **AQUIFER** system, but it also provides wildlife **HABITAT** and promotes nesting of migratory waterfowl. The Forest Highlands Water Company purchases KVID’s excess treated wastewater for golf course irrigation. (Forest Highlands also uses its own treated wastewater but does not produce enough for its irrigation needs.) Other golf courses in Flagstaff, Williams, Page, and Pinewood use treated wastewater to meet some, if not all, their irrigation needs. Grand Canyon National Park Airport is also noteworthy because it harvests potable water via its rainwater collection system, which includes a 3-million-gallon tank to store untreated water. Harvesting also occurs on a much smaller scale throughout the county, especially in remote areas, where residents would otherwise have to rely solely on hauled water.

The County can promote water conservation and alternative water sources in a variety of ways—educating the public, developers, and County staff; creating incentives for incorporating conservation elements into development projects; and supporting the use of gray-water systems and water harvesting. In 2001, the County adopted the *Coconino County*

*Landscape Ordinance* based on **XERISCAPE** principles for new, nonresidential development; this ordinance requires the use of native and/or drought-tolerant plants, based on geographic location. Another technique to consider is reducing impervious surface areas to allow water to **RECHARGE** aquifers instead of becoming runoff. New technologies are constantly emerging that can help us reduce our consumption of this precious resource.



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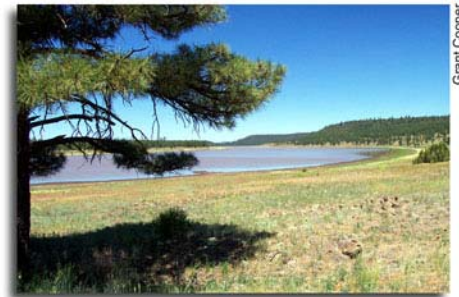




**Goal:** Promote water conservation practices and the use of alternative sources.

**Policies:**

5. The County shall strongly encourage reuse of wastewater not only to minimize discharge but also to reduce the use of potable water. *SEE CONSERVATION GUIDELINES: G, H*
6. The County encourages decreased water use and promotes the use of such conservation tools as water saving plumbing fixtures and environmentally sound water harvesting systems. *SEE CONSERVATION GUIDELINE: G*
7. The County shall set an example in new and existing County facilities by utilizing water conservation techniques. *SEE CONSERVATION GUIDELINE: G*
8. Water conservation should be a consideration in approval of all major developments. *SEE CONSERVATION GUIDELINE: G*
9. With new commercial and industrial development, high-efficiency, low-net volume water users are encouraged. *SEE CONSERVATION GUIDELINE: G*
10. The County encourages individual homeowners and businesses to reduce water use, provide for detention of rainwater, and control erosion. *SEE CONSERVATION GUIDELINE: G, I*
11. Where environmentally appropriate, the County encourages the use of alternatives such as treated wastewater and water harvesting for recreation uses and other nonpotable needs. *SEE CONSERVATION GUIDELINE: G*
12. Subject to other jurisdictional authority, the reuse of treated wastewater and gray water should be encouraged wherever possible for both residential and commercial irrigation and for commercial and industrial purposes. *SEE CONSERVATION GUIDELINES: G, I*
13. In conjunction with considerations for dust control, drainage, and maintenance, the County supports alternative paving methods that mitigate the impacts of surface water runoff and conserve water by promoting aquifer recharge. *SEE CONSERVATION GUIDELINES: B, C, G, H, I*



Grant Cooper



Grant Cooper



Abe Springer

## Water Quality

The quality of **SURFACE WATERS** in Coconino County—rivers, streams, creeks, lakes, and reservoirs—is generally excellent. ADEQ monitors surface water in a small network of fixed stations. Most of these waters meet drinking water standards that are based on *Clean Water Act* criteria published by the **U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)**. One waterway, Oak Creek, is subject to more stringent standards because it was designated a “unique water” by the state in 1982. This designation ensures that no degradation of water quality results from nearby **WASTEWATER** systems.



The quality of the county's **GROUNDWATER** is also generally excellent, in part because water levels are deep and therefore less vulnerable to **POLLUTION** from surface sources. Groundwater depths of 1,000 feet or more are common throughout the county. However, in a few areas, most notably the Fort Valley area of Flagstaff, water levels are close to the surface. Although shallow aquifers are more susceptible to impacts from on-site wastewater systems, they are generally not used for drinking water.

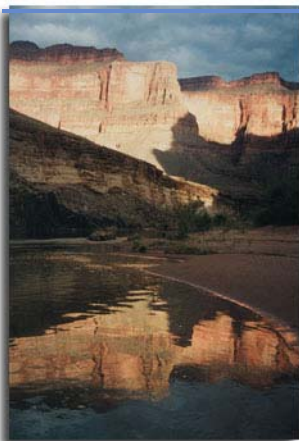
About 20 wastewater discharge permits have been issued in the county through the **NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)**. These permits are processed by ADEQ and issued by the EPA. Permit holders include the Cities of Flagstaff and Williams, Grand Canyon National Park, Tuba City, Cameron, Kaibito, Tusayan, Pine-wood, and Valle Airpark. These permits specify the water quality standards that the holder must meet before it can **DISCHARGE** treated wastewater. They apply only to the wastewater that is discharged to the surface, not to any treated wastewater that is reused for nonpotable purposes such as landscaping.

Concerns are often raised about the impact of septic systems on groundwater. As long as there is a sufficient thickness of soil under leach fields—typically, only a few feet—the potential for pathogens reaching groundwater is minimized. Of greater concern are the nitrates that originate from septic leach fields and other sources. Driven by heavy rains, these nitrates can infiltrate into aquifers, particularly in areas containing loose cinders or faults. Doney Park, a good example of an area containing loose cinders, has not reported an increase in nitrate levels.

**NONPOINT SOURCES** of pollution also affect surface water and groundwater. The most likely sources of concern include **EROSION** of sediment from disturbed sites; stormwater **RUNOFF** from streets, parking areas, and other impervious surfaces; and surface runoff from **WATERSHEDS** carrying pathogens from recreation, wildlife, and livestock.

#### NONPOINT-SOURCE POLLUTION

Pollution that originates from many diffuse sources (such as urban areas, parking lots, agriculture, recreation, and construction) and that is carried by rainfall, snowmelt, irrigation, and local runoff.



**Goal:** Protect, preserve, and improve the quality of surface water and groundwater.

#### Policies:

14. Protection of the quality of surface waters and groundwater shall be a factor in the consideration for approval of residential, commercial, and industrial developments. *SEE CONSERVATION GUIDELINES: B, I*
15. Development proposals that will affect drainage on adjacent properties, roads, or watercourses shall include a drainage plan addressing the impacts and mitigation measures affecting water quality. *SEE CONSERVATION GUIDELINES: A, B, C, H, I*
16. To reduce stormwater runoff, the County encourages minimizing impervious surfaces within commercial, industrial, public and semipublic use developments. *SEE CONSERVATION GUIDELINES: B, I*
17. The County shall set an example of responsible water resource protection by locating its new buildings, roads, and other facilities in such a way as to protect surface water and groundwater quality. *SEE CONSERVATION GUIDELINES: B, I*

## Regulatory Framework

The **GROUNDWATER MANAGEMENT ACT** of 1980 created a number of **ACTIVE MANAGEMENT AREAS (AMAs)** throughout the state. At that time, Coconino County was not considered at risk for **OVERDRAFT** and **WATER TRANSFERS**; consequently, it was not included in an AMA. Outside of established AMAs, the state requires those drilling wells to obtain a permit. It also limits **INTER-BASIN TRANSFERS** through the *Groundwater Transportation Act*.

#### OVERDRAFT

The removal of more groundwater from an aquifer than is naturally replenished through recharge.



The County has faced substantial limits in its ability to assess the availability of groundwater and the impacts of withdrawing it from wells. It lost two lawsuits in 1988 and 1989, both involving **CONDITIONAL USE PERMITS** for water transfer sites. In each case, neighboring residents raised concerns that nearby large-scale pumping would lower water levels in their wells. The Court determined that the County could not consider this issue in evaluating the permit applications—such issues fall under the jurisdiction of ADWR, which imposes very few requirements on those withdrawing groundwater from deep aquifers outside AMAs. This legal situation clearly limits the County’s ability to assess how growth and development affect its water resources. Obtaining more local authority over groundwater issues would benefit County planning efforts tremendously.

**Goal:**      **To address groundwater management at a local and regional level.**

**Policies:**

18. In coordination with the appropriate agencies, the County supports activities to create more local/regional authority for groundwater management. *SEE CONSERVATION GUIDELINES: A, G*
19. The County will participate in and pursue programs and activities that address regional water resources conservation and management. *SEE CONSERVATION GUIDELINES: A, B, G*
20. To the extent allowed by state law, availability of water should be a consideration for all major developments and subdivision applications filed in conjunction with a rezoning for higher density. *SEE CONSERVATION GUIDELINES: B, G*



**OLIVER WENDELL HOLMES, SR.**

*"The greatest thing in the world  
is not so much where we stand,  
as in what direction we are  
moving."*

